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Research and Development of Biosensors in Japan

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The research and development of biosensors in Japan are described in this paper. In the last 15 yr, microfabrication techniques based on integrated circuit technology, such as photolithography and etching, were applied to other fields. These techniques, which are used to make some small and efficient three-dimensional devices, are called micromachining. Furthermore, some studies to make miniaturized chemical analysis systems were already reported. These analysis systems have some advantages, such as fast response, small amount of sample, and low consumption of reagents, as compared with the conventional system. We applied micromachining techniques to make a miniaturized enzyme-based sensor system.

The determination of organic compounds in urine is important in clinical analysis. Adult diseases are increasing because of today's aging society. Thus, easy methods to measure health index components in urine that everyone can use at home is required. Glucose in urine is a index component of diabetes and can be measured with a GOD-hydrogen peroxide electrode system. The protein in urine is an index component of kidney disease and the protein measuring biosensor using quartz crystal oscillation was developed by our group.

Other kinds of biosensors using thermistors, ISFET, and photon counters were also developed. When these biosensors are miniaturized and mass produced with silicon technologies, they will become inexpensive and disposable. Embodying these biosensors in a toilet stool, we can get a lot of information about our health. By transmitting these data to the hospital, they can be used for screening of adult disease and for receiving advice from health control.

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Glutamate is one of the neurotransmitters. After releasing from presynaptic neuron, it binds to specific receptors on the postsynaptic neuron. Interactions between glutamate and glutamate receptor are strongly related to memory storage phenomena known as long-term potentiation in hippocampus and long-term depression in cerebellar. Quantitative analyses of released glutamate are needed for clarification of molecular mechanism, especially in the long term depression phenomena. In vivo glutamate sensors are powerful tools to elucidate the sites of action in the brain where glutamate operates. In our study, a microglutamate sensor was applied to the determination of glutamate released from cerebellar neurons.